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ABSTRACT:

PURPOSE: To provide a process and apparatus for the production of an optical fiber capable of facilitating the control of fiber diameter and drawing speed in the drawing of a large-sized optical fiber preform and remarkably shortening the time necessary for increasing the drawing speed.

CONSTITUTION: An optical fiber preform 11 is heated and melted in a drawing furnace 12 having a heater, a coating layer is applied to the surface of the drawn optical fiber 13 and the fiber is wound. The optical fiber production apparatus having the above function is provided with a 1st outer diameter gauge 14 to measure the outer diameter of the drawn optical fiber 11 and control the drawing speed according to the measured diameter and with a 2nd outer diameter gauge 21 placed upstream of the 1st gauge and measuring the outer diameter of the drawn optical fiber before the drawing speed of the optical fiber 13 reaches a prescribed drawing speed (≥100m/min).

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(54) PRODUCTION OF OPTICAL FIBER AND APPARATUS FOR PRODUCING OPTICAL FIBER

(57)Abstract:

PURPOSE: To provide a process and apparatus for the production of an optical fiber capable of facilitating the control of fiber diameter and drawing speed in the drawing of a large-sized optical fiber preform and remarkably shortening the time necessary for increasing the drawing speed.

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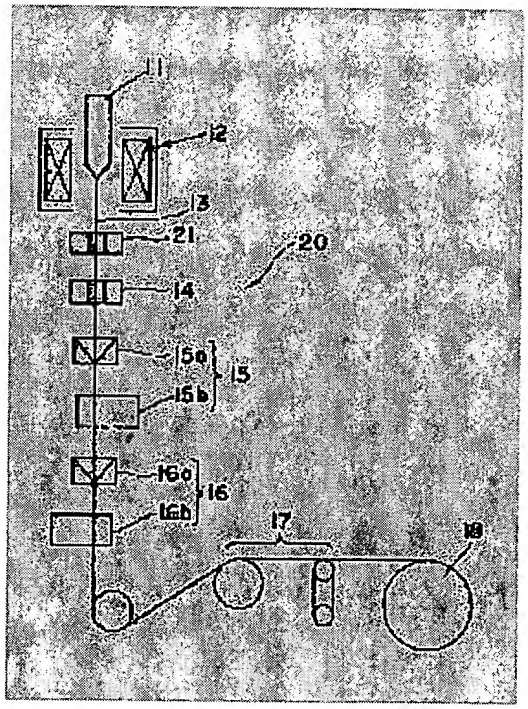

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* NOTICES *

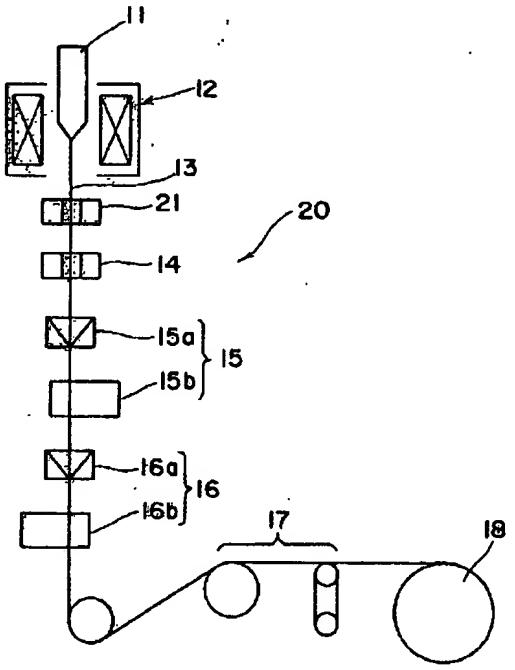
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] The manufacture approach of the optical fiber characterized by to switch an optical fiber outer diameter to the narrow measuring instrument of a measurement visual field, and to measure it when it is the manufacture approach of the optical fiber which carries out heating fusion and carries out wire drawing of the optical fiber preform in a wire-drawing furnace, an optical fiber outer diameter measures with the large measuring instrument of a visual field at the time of the linear-velocity rise at the time of the interference from the wire-drawing furnace of the optical fiber of a measurement visual field between a wire-drawing furnace and the outer-diameter measuring instrument for wire diameter control and it considers as the drawing linear velocity of a stationary.
[Claim 2] It sets to claim 1 and the drawing linear velocity of a stationary is 100 m/min. The manufacture approach of the optical fiber characterized by being the above predetermined rate.
[Claim 3] In the manufacturing installation of the optical fiber rolled round after carrying out heating fusion of the optical fiber preform, drawing a line in the wire-drawing furnace which has a heating heater and giving an enveloping layer subsequently to the front face of an optical fiber To the upstream of the first outer-diameter measuring instrument which controls a wire-drawing rate corresponding to the diameter of measurement while measuring the outer diameter of a wire-drawing optical fiber The manufacturing installation of the optical fiber characterized by arranging the second outer-diameter measuring instrument which measures the outer diameter of a wire-drawing optical fiber until wire drawing of an optical fiber reaches a predetermined wire-drawing rate.
[Claim 4] The manufacturing installation of the optical fiber with which the second measurement visual field and accuracy of measurement of an outer-diameter measuring instrument are characterized by measuring range being wider than the first measurement visual field and accuracy of measurement of an outer-diameter measuring instrument in claim 3.

[Translation done.]

Drawing selection Representative drawing



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DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Industrial Application] When this invention draws a line in a large-sized optical fiber preform, it relates to the manufacture approach of the optical fiber which can make easy wire diameter control and linear velocity control, and can shorten the linear velocity rise time sharply, and the manufacturing installation of an optical fiber.
[0002]
[Description of the Prior Art] After covering by drawing a line in an optical fiber strand from an optical fiber preform using an optical fiber manufacturing installation for generally manufacturing an optical fiber, the test of tensile strength is carried out and it is rolling round with the reel.
[0003] The manufacturing installation of the common optical fiber to drawing 2 is shown. As shown in this drawing, the optical fiber manufacturing installation 10 The wire-drawing furnace 12 which draws a line in an optical fiber preform 11, and the outer-diameter measuring instrument 14 which measures the outer diameter of the optical fiber 13 on which a line was drawn, The first covering section 15 which consists of die 15a and curing oven 15b which give first covering to the periphery of an optical fiber 13, The second covering section 16 which consists of die 16a and curing oven 16b which give second covering, the screening section 7 which gives fixed tension to an optical fiber 13 and tests tensile strength, and the reel 18 which rolls round an optical fiber 13 are provided.
[0004]
[Problem(s) to be Solved by the Invention] An optical fiber is manufactured controlling [heat an optical fiber preform, carry out spinning, take over the glass outer diameter of the obtained optical fiber strand so that an optical fiber strand may become a fixed glass outer diameter with an outer-diameter measuring instrument, and] the wire-drawing rate of a capstan. However, in carrying out high-speed wire drawing of a large-sized base material, there are the following problems.
[0005] A) the outer-diameter measuring instrument 14 for wire-size control -- directly under [conventional / wire-drawing furnace] -- 1-2 -- it lowers downward about m, and unless it carries out high-speed wire drawing, wire-size control cannot be carried out in the precision of 125**0.3 micrometers or less.
B) the outer-diameter measuring instrument 14 for wire-size control -- directly under [conventional / wire-drawing furnace] -- 1-2 -- since it lowered downward about m, below by linear-velocity 100 m/min., the amount of line deflections a lifting, consequently near the inlet port of the outer-diameter measuring instrument 14 is set to **10mm by the optical fiber in a line deflection, wire-size control and linear velocity control become difficult, and there are troubles, like as a result, a linear velocity rise takes time amount.
[0006] Even if this invention faces a large-sized optical fiber preform drawing a line in view of the above-mentioned problem, it makes easy wire-size control and linear velocity control, and aims at the manufacture approach of the optical fiber which can shorten the linear velocity rise time sharply, and the manufacturing installation of an optical fiber.

[0007]
[Means for Solving the Problem] The manufacture approach of the optical fiber concerning this invention which attains said purpose Are the manufacture approach of the optical fiber which carries out heating fusion and carries out wire drawing of the optical fiber preform in a wire-drawing furnace, and it sets between a wire-drawing furnace and the outer-diameter measuring instrument for wire diameter control. When an optical fiber outer diameter is measured with a large measuring instrument at the time of the linear velocity rise of the interference from the wire-drawing furnace of the optical fiber of a measurement visual field etc. and is made into the drawing linear velocity of a stationary, it is characterized by switching an optical fiber outer diameter to the narrow measuring instrument of a measurement visual field, and measuring it.
[0008] Moreover, the manufacturing installation of the optical fiber concerning one this invention In the manufacturing installation of the optical fiber rolled round after carrying out heating fusion of the optical fiber preform, drawing a line in the wire-drawing furnace which has a heating heater and giving an enveloping layer subsequently to the front face of an optical fiber While measuring the outer diameter of a wire-drawing optical fiber, it is characterized by arranging the second outer-diameter measuring instrument which measures the outer diameter of a wire-drawing optical fiber until wire drawing of an optical fiber reaches a predetermined wire-drawing rate in the upstream of the first outer-diameter measuring instrument which controls a wire-drawing rate corresponding to the diameter of measurement.
[0009]
[Example] Hereafter, one suitable example concerning this invention is explained with reference to a drawing. Drawing 1 is the schematic diagram of the optical fiber manufacturing installation concerning this example.
[0010] As shown in this drawing, the optical fiber manufacturing installation 20 The wire-drawing furnace 12 which draws a line in an optical fiber preform 11, and the first outer-diameter measuring instrument 14 which measures the outer diameter of the optical fiber 13 on which a line was drawn, The first covering section 15 which consists of die 15a and curing oven 15b which give first covering to the periphery of an optical fiber 13, The second covering section 16 which consists of die 16a and curing oven 16b which give second covering, the screening section 17 which gives fixed tension to an optical fiber 13 and tests tensile strength, and the reel 18 which rolls round an optical fiber 13 are provided.
[0011] In this example, the second outer-diameter measuring instrument 21 for measuring the outer diameter of the wire-drawing optical fiber 13 which can be set by the time the drawing rate of an optical fiber reaches a predetermined rate is arranged in the upstream of the first same outer-diameter measuring instrument 14 as the former which measures the outer diameter of the wire-drawing optical fiber 13 near the interference of the optical fiber 13 of the wire-drawing furnace 12.
[0012] The outer-diameter measuring instrument 14 of the above first is the same as usual, and is always supervising the outer diameter of the wire-drawing optical fiber of a steady state with which the drawing rate became predetermined linear velocity, and he is trying to control a wire-drawing rate corresponding to the measurement outer diameter. Generally the measurement visual field of this first outer-diameter measuring instrument 14 is as narrow as 1x2 (mm) or 2x2 (mm), and that accuracy of measurement uses **0.3 micrometers and a highly precise thing.
[0013] Moreover, the second outer-diameter measuring instrument 21 measures the outer diameter of the wire-drawing first stage until linear velocity turns into predetermined linear velocity from the time of optical fiber wire-drawing interference, the measurement visual field of this second outer-diameter measuring instrument 21 is as large as 5x30 (mm) or 12x12 (mm), and that accuracy of measurement uses **5 micrometers and the thing of comparatively low precision.
[0014] Next, an example of manufacture of the optical fiber using a large-sized optical fiber preform is explained. The large-sized optical fiber preform 11 is installed in the wire-drawing furnace 12, heating fusion is carried out, linear velocity is raised to ****, and drawing is started. For outer-diameter measurement of an optical fiber 13, it measures using the second outer-diameter measuring instrument 21 at the time of this linear velocity rise. And when it becomes predetermined linear velocity (linear

velocity is 100 m/min above), it is measured as usual using the first outer-diameter measuring instrument 21.

[0015] Thus, by using the separate outer-diameter measuring instrument with which a measurement visual field differs from the accuracy of measurement respectively at the time of the first linear velocity rise in the wire-drawing head, and stationary wire drawing, even if there is a line deflection (**4mm) of the optical fiber at the time of the low linear velocity at the time of a linear velocity rise, outer-diameter measurement can be carried out with a large visual field, and linear velocity control can be performed. As a result, linear velocity time amount was able to be shortened sharply.

[0016] that is, it is shown in conventional drawing 2 -- as -- directly under [wire-drawing furnace] -- 1-2 -- in the former lowered downward about m, the amount of line deflections was set to **10mm near the inlet port of the first outer-diameter measuring instrument 14, wire-size control and linear velocity control were very difficult, the linear velocity rise time had started sharply, but this problem was solved by using two kinds of outer-diameter measuring instruments like this approach. In the case of this example, what had taken about about 2 hours for as a result becoming the linear velocity (100 m/min) of a steady state by the former was able to aim at compaction of about 30 minutes and the time amount of about 1/4.

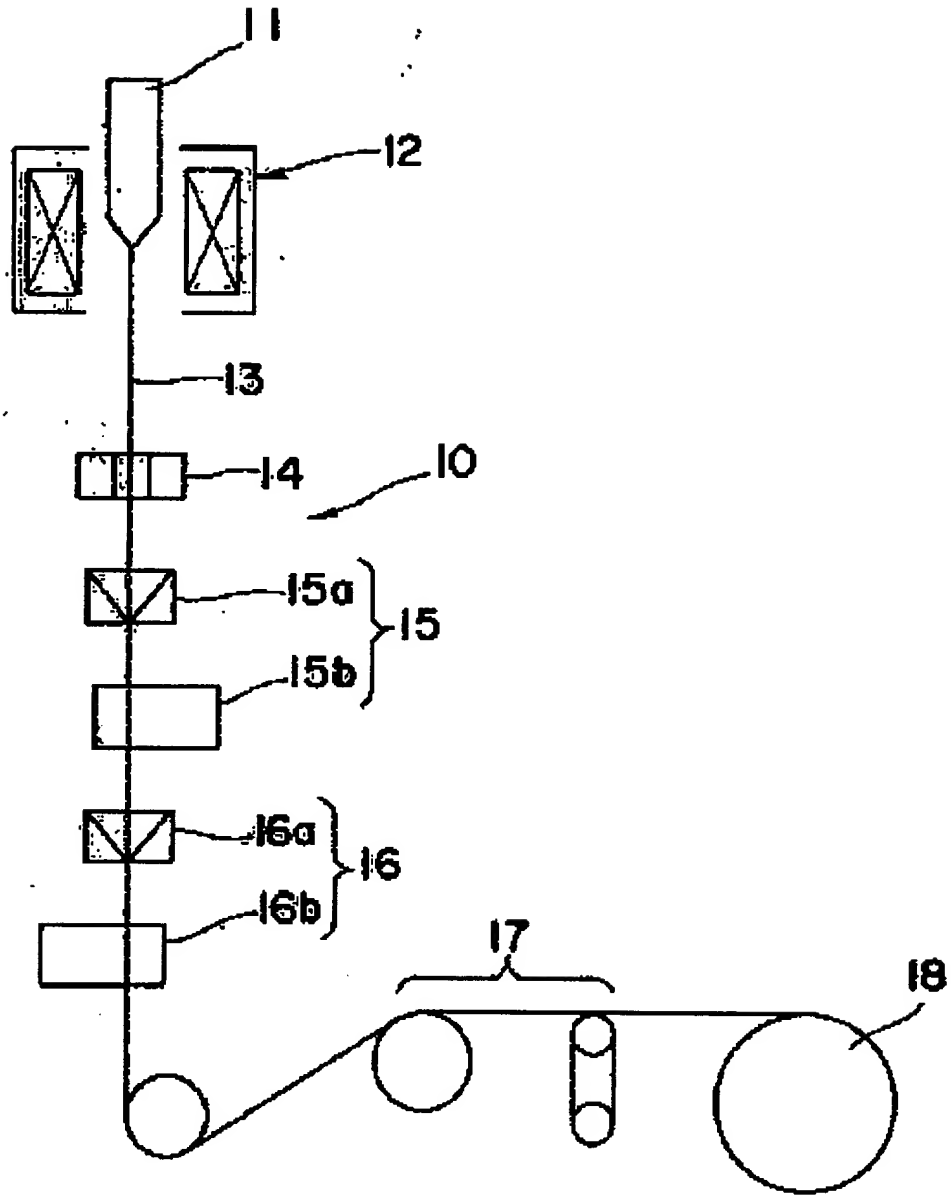
[0017] Furthermore, what was carrying out wire drawing of the optical fiber of use impossible also for about 2 hours conventionally can be managed with drawing for 30 minutes, and the rate's of an optical fiber preform of a deployment improves.

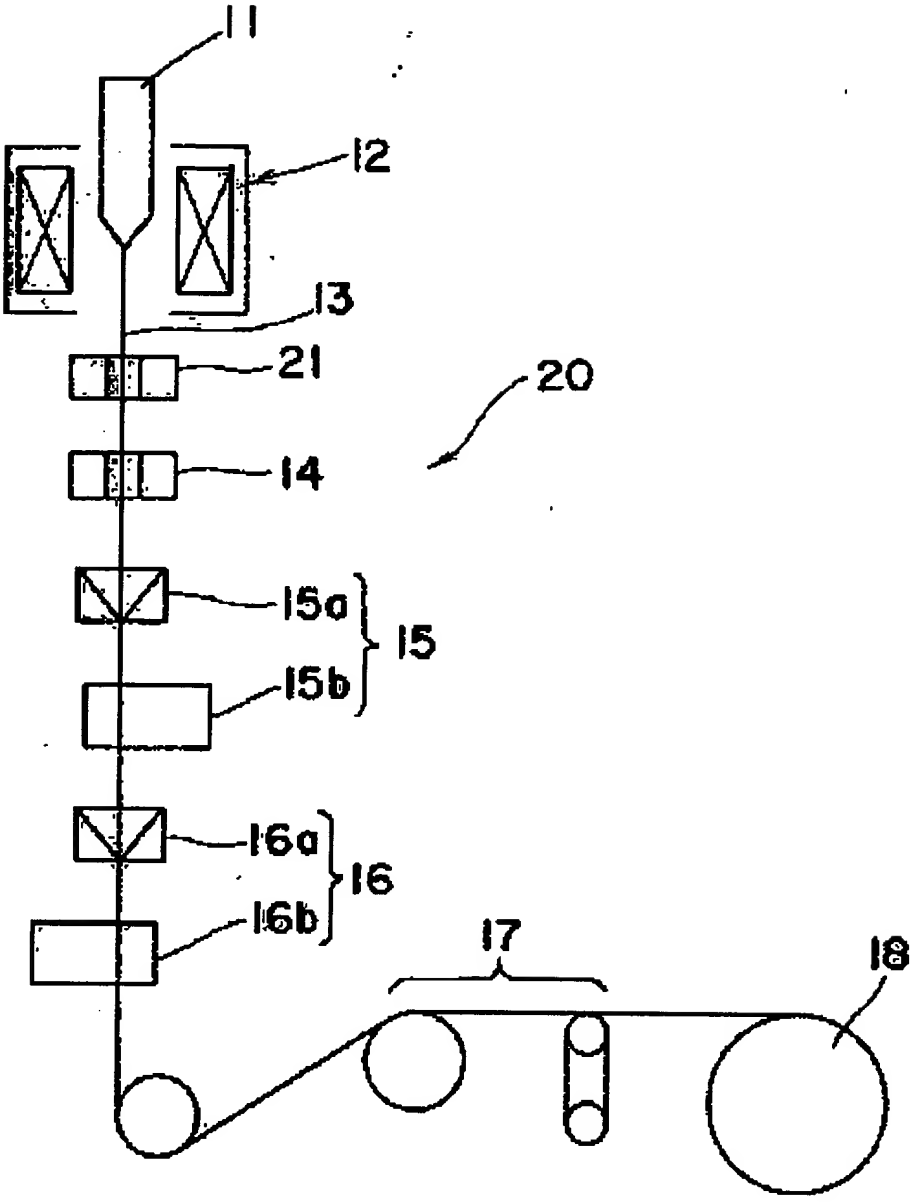
[0018]

[Effect of the Invention] As explained with the example above, according to this invention, even if it uses a large-sized optical fiber preform, the wire-size control and linear velocity control at the time of interference can become easy, the time of the linear velocity rise to stationary linear velocity can be shortened sharply, and the loss of time amount and the loss of an optical fiber preform can be made into the minimum.

[Translation done.]

Drawing 2

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15a
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15b
16a
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16b
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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1] It is the schematic diagram of the optical fiber manufacturing installation concerning this example.
[Drawing 2] It is the schematic diagram of the optical fiber manufacturing installation concerning the conventional technique.
[Description of Notations]
11 Optical Fiber Preform
12 Wire-Drawing Furnace
13 Optical Fiber
14 First Outer-Diameter Measuring Instrument
15 First Covering Section
16 Second Covering Section
17 Screening Section
18 Reel
21 Second Outer-Diameter Measuring Instrument

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審査請求　未請求　請求項の数４　ＯＬ　（全　４　頁）

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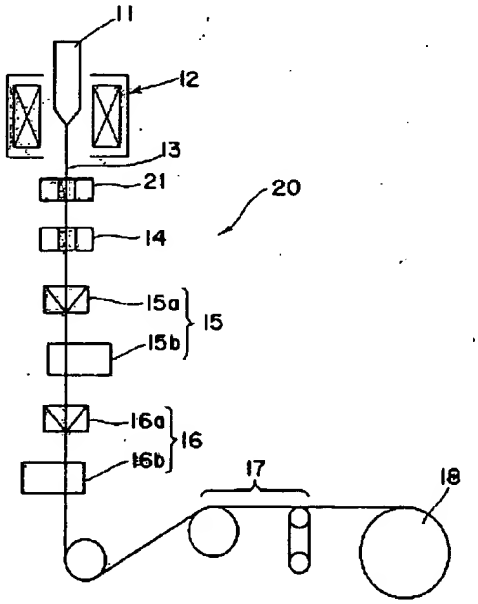
(54)【発明の名称】　光ファイバの製造方法及び光ファイバの製造装置

(57)【要約】

【目的】　大型光ファイバ母材を線引きした際に線経制御と線速制御とを容易にし線速上昇時間を大幅に短縮することができる光ファイバの製造方法及び製造装置を提供することを目的とする。

【構成】　加熱ヒータを有する線引炉１２内で光ファイバ母材１１を加熱溶融して線引きし、次いで光ファイバ１３の表面に被覆層を施した後、巻取する光ファイバの製造装置において、線引光ファイバ１１の外径を測定すると共にその測定径に対応して線引速度を制御する第１の外径測定器１４の上流側に、光ファイバ１３の線引が所定線引速度（１００m/min 以上）に達するまでの間の線引光ファイバの外径を測定する第二の外径測定器２１を配設した。



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【特許請求の範囲】

【請求項1】　光ファイバ母材を線引炉内で加熱溶融して線引する光ファイバの製造方法であって、線引炉と線経制御用の外径測定器との間において、測定視野の光ファイバの線引炉からの口出し時の線速上昇時には、光ファイバ外径を視野の広い測定器で測定し、定常の線引き線速度とした時には、光ファイバ外径を測定視野の狭い測定器に切換えて測定することを特徴とする光ファイバの製造方法。

【請求項2】　請求項1において、定常の線引き線速度が100m/min 以上の所定の速度であることを特徴とする光ファイバの製造方法。

【請求項3】　加熱ヒータを有する線引炉内で光ファイバ母材を加熱溶融して線引きし、次いで光ファイバの表面に被覆層を施した後、巻取する光ファイバの製造装置において、

線引光ファイバの外径を測定すると共にその測定径に対応して線引速度を制御する第一の外径測定器の上流側に、光ファイバの線引が所定線引速度に達するまでの間の線引光ファイバの外径を測定する第二の外径測定器を配設したことを特徴とする光ファイバの製造装置。

【請求項4】　請求項3において、第二の外径測定器の測定視野及び測定精度が、第一の外径測定器の測定視野及び測定精度より測定範囲が広いことを特徴とする光ファイバの製造装置。

【発明の詳細な説明】

【0001】

【産業上の利用分野】本発明は、大型光ファイバ母材を線引きした際に線経制御と線速制御とを容易にし線速上昇時間を大幅に短縮することができる光ファイバの製造方法及び光ファイバの製造装置に関する。

【0002】

【従来の技術】一般に、光ファイバを製造するには光ファイバ製造装置を用い、光ファイバ母材から光ファイバ素線を線引きし、被覆を施した後、抗張力のテストをし、巻取機によって巻取っている。

【0003】図2に一般的な光ファイバの製造装置を示す。同図に示すように、光ファイバ製造装置10は、光ファイバ母材11を線引きする線引炉12と、線引きされた光ファイバ13の外径を測定する外径測定器14と、光ファイバ13の外周に、第一の被覆を施すダイ15a及び硬化炉15bとからなる第一被覆部15と、第二の被覆を施すダイ16a及び硬化炉16bとからなる第二被覆部16と、光ファイバ13に一定の張力を与え、抗張力をテストするスクリーニング部7と、光ファイバ13を巻取る巻取機18とを具備するものである。

【0004】

【発明が解決しようとする課題】光ファイバ母材を加熱して紡糸し、得られた光ファイバ素線のガラス外径を外径測定器で光ファイバ素線が一定のガラス外径になるように引き取りキャプスタンの線引速度を制御しながら光ファイバの製造を行う。しかしながら、大型母材の高速線引を実施する場合には、以下のような問題がある。

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【0005】A）線径制御用の外径測定器14を従来の線引炉直下より1～2m程度下にさげて高速線引しないと125±0.3μm以下の精度で線径制御できない。

B）線径制御用の外径測定器14を従来の線引炉直下より1～2m程度下にさげた為、線速度100m/min.以下では光ファイバが線振れを起こし、その結果、外径測定器14の入口近傍での線振れ量が±10mmとなり、線径制御と線速制御とが難しくなり、その結果線速上昇に時間が掛かる等の問題点がある。

【0006】本発明は上記問題に鑑み、大型の光ファイバ母材を線引きするに際しても、線径制御と線速制御とを容易にし、線速上昇時間を大幅に短縮することができる光ファイバの製造方法及び光ファイバの製造装置を目的とする。

【0007】

【課題を解決するための手段】前記目的を達成する本発明に係る光ファイバの製造方法は、光ファイバ母材を線引炉内で加熱溶融して線引する光ファイバの製造方法であって、線引炉と線経制御用の外径測定器との間において、光ファイバ外径を測定視野の光ファイバの線引炉からの口出し等の線速上昇時には、広い測定器で測定し、定常の線引き線速度とした時には、光ファイバ外径を測定視野の狭い測定器に切換えて測定することを特徴とする。

【0008】また、一方の本発明に係る光ファイバの製造装置は、加熱ヒータを有する線引炉内で光ファイバ母材を加熱溶融して線引きし、次いで光ファイバの表面に被覆層を施した後、巻取する光ファイバの製造装置において、線引光ファイバの外径を測定すると共にその測定径に対応して線引速度を制御する第一の外径測定器の上流側に、光ファイバの線引が所定線引速度に達するまでの間の線引光ファイバの外径を測定する第二の外径測定器を配設したことを特徴とする。

【0009】

【実施例】以下、本発明に係る好適な一実施例を図面を参照して説明する。図1は本実施例に係る光ファイバ製造装置の概略図である。

【0010】同図に示すように、光ファイバ製造装置20は、光ファイバ母材11を線引きする線引炉12と、線引きされた光ファイバ13の外径を測定する第一の外径測定器14と、光ファイバ13の外周に、第一の被覆を施すダイ15a及び硬化炉15bとからなる第一被覆部15と、第二の被覆を施すダイ16a及び硬化炉16bとからなる第二被覆部16と、光ファイバ13に一定の張力を与え、抗張力をテストするスクリーニング部17と、光ファイバ13を巻取る巻取機18とを具備するものである。

【００１１】本実施例においては、線引炉１２の光ファイバ１３の口出し近傍で線引光ファイバ１３の外径を測定する従来と同様の第一の外径測定器１４の上流側に、光ファイバの線引き速度が所定速度に達するまでの間における線引光ファイバ１３の外径を測定するための第二の外径測定器２１を配設している。

【００１２】上記第一の外径測定器１４は従来と同様のものであり、線引き速度が所定線速となった定常状態の線引光ファイバの外径を常に監視しており、その測定外径に対応して線引速度を制御するようにしている。この第一の外径測定器１４の測定視野は一般に１×２（㎜）あるいは２×２（㎜）と狭いものであり、またその測定精度は±0.３μｍと高精度のものを用いている。

【００１３】また、第二の外径測定器２１は、光ファイバ線引口出し時から線速が所定線速となるまでの線引初期の外径を測定するものであり、この第二の外径測定器２１の測定視野は５×３０（㎜）又は１２×１２（㎜）と広いものであり、また、その測定精度は±５μｍと比較的低精度のものを用いている。

【００１４】次に大型光ファイバ母材を用いた光ファイバの製造の一例を説明する。線引炉１２内に大型光ファイバ母材１１を設置し、加熱溶融し除々に線速を上昇させ線引きを開始する。この線速上昇時においては光ファイバ１３の外径測定には第二の外径測定器２１を用いて測定する。そして所定線速（例えば線速が１００m/min以上）となった場合には、第一の外径測定器２１を用いて従来と同様に測定する。

【００１５】このように線引頭初の線速上昇時と定常線引時とにおいて各々測定視野及び測定精度の異なる別々の外径測定器を用いることで、線速上昇時の低線速時における光ファイバの線振れ（±４㎜）があっても広い視野で外径測定でき、線速制御ができる。この結果線速時間を大幅に短縮することができた。

【００１６】すなわち、従来の図２に示すように、線引

炉直下より１～２m程度下に下げた従来の場合、第一の外径測定器１４の入口近傍では線振れ量が±１０㎜となり線径制御と線速制御とが極めて難しく、線速上昇時間が大幅にかかっていたが、本方法のように二種類の外径測定器を用いることにより、この問題が解消された。この結果定常状態の線速（１００m/min）となるのに従来では約２時間程度かかっていたものが、本実施例の場合には約３０分と約4分の１もの時間の短縮を図ることができた。

【００１７】さらに、従来約２時間にも亙って使用不能の光ファイバを線引していたものが、３０分の線引きで済み光ファイバ母材の有効利用率も向上する。

【００１８】

【発明の効果】以上実施例と共に説明したように、本発明によれば、大型の光ファイバ母材を用いても口出し時の線径制御及び線速制御が容易となり、定常線速までの線速上昇時を大幅に短縮することができ、時間のロス及び光ファイバ母材のロスを最小限とすることができる。

【図面の簡単な説明】

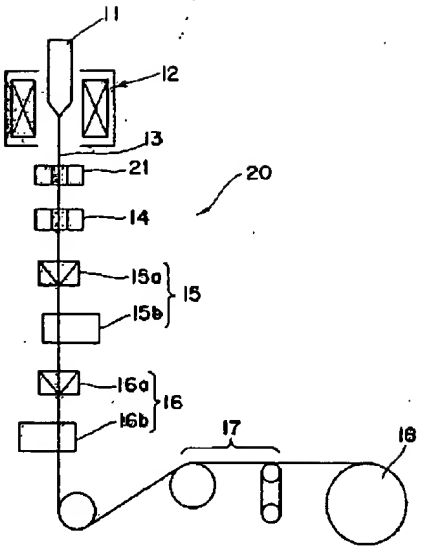
【図１】本実施例に係る光ファイバ製造装置の概略図である。

【図２】従来技術に係る光ファイバ製造装置の概略図である。

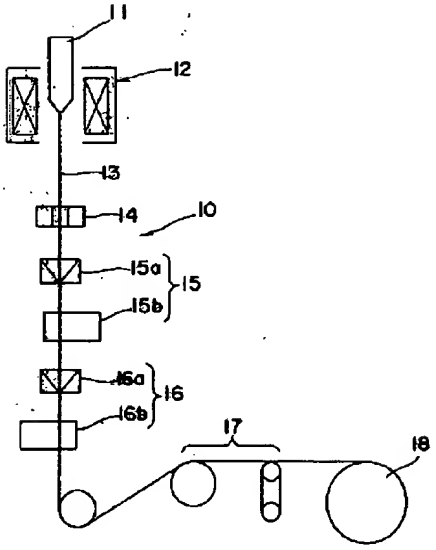
【符号の説明】

１１　光ファイバ母材
１２　線引炉
１３　光ファイバ
１４　第一の外径測定器
１５　第一被覆部
１６　第二被覆部
１７　スクリーニング部
１８　巻取機
２１　第二の外径測定器

【図1】


11
12
13
21
20
14
15a
15
15b
16a
16
16b
17
18

【図2】


11
12
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15a
15
15b
16a
16
16b
17
18